Kerr, Michelle

From: Kerr, Michelle
Sent: Thursday, July 18, 2013 11:16 AM
To: 'Patrick Steerman'
Subject: RE: CRS Site Sections of the TI Waiver

Hi Pat, we were wondering if you could give us an estimated volume (yd3) of the most highly contaminated zone (impacted by NAPLs) at the site. (We understand there is an estimate of total NAPL mass in Table 4-2 of the TI Assessment.) Also, I thought one of the centrifugal tests methods used heat to measure extractability/mobility of the NAPL from the rock. Can you clarify/correct on this?

Thank you,
Michelle

From: Patrick Steerman [mailto:psteerman@charter.net]
Sent: Friday, July 12, 2013 1:45 PM
To: Kerr, Michelle; Karl, Richard; Nash, Thomas; Larry Antonelli
Cc: Doug McWilliams; Nigel Goulding; Mike Watkins; tom.biksey@ehs-support.com
Subject: Re: CRS Site Responses to U.S. EPA and Ohio EPA Comments on the HHRA & SLERA Sections of the TI Waiver

Earlier today, in the message below, I provided a "red-lined" version of Group responses to USEPA and Ohio comments on the HHRA and the SLERA sections of the TI Waiver Assessment. This version was provided to allow USEPA and Ohio EPA reviewers to see modifications that were made to the draft responses provided on April 10, 2013, and discussed during a May 22, 2013, conference call. Attached for your files is a "black-line" version of the responses in which all changes have been accepted.

Please give me a call or respond to this message if you have any questions or comments.

Best Regards,

Pat

Patrick S. Steerman

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Michelle:

Enclosed are Group responses to USEPA and Ohio comments on the HHRA and the SLERA sections of the TI Waiver Assessment.

As discussed in the enclosed transmittal letter, the Settling Performing Defendants in the Chemical Recovery Systems, Inc. (CRS) Site (the Site) Remedial Design/Remedial Action (RD/RA) Group (the Group), submitted a

draft Technical Impracticability Waiver Assessment (the TI Assessment) to the United States Environmental Protection Agency (USEPA). During a January 3, 2013, teleconference with the Group, USEPA presented and discussed their preliminary comments on the TI Assessment. In a letter dated January 22, 2013, the USEPA provided questions and comments on the TI Assessment. On April 10, 2013, the Group provided draft responses to USEPA's comments on the Human Health Risk Assessment ("HHRA") and the Screening Level Ecological Risk Assessment ("SLERA") and the draft responses were discussed in a May 22, 2013, conference call with USEPA and Ohio EPA. Enclosed are Group responses to USEPA's comments on the HHRA and the SLERA that were developed based on discussion during the May 22, 2013, conference call.

Printed copies of the enclosed response will be sent to you later today by overnight mail. Please give me a call or respond to this message if you have any questions.

Best Regards,

Pat

Patrick S. Steerman

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Kerr, Michelle

From: Patrick Steerman [psteerman@charter.net]
Sent: Tuesday, July 23, 2013 5:33 PM
To: Kerr, Michelle
Cc: Doug McWilliams
Subject: CRS SIte Volume of Highly Contaminate Material
Attachments: 07-23-13 CRS Site EHS Response to USEPA July 18th 2013 Information Request.docx

Michelle:

Attached is a response prepared by EHS, on behalf of the Group, that responds to your July 18, 2013 email requesting information related to the volume of highly contaminated material at the CRS Site and a question related to rock testing. I hope that this provides the information that you require. Please do not hesitate to contact me if you have questions or require additional information.

Best Regards,

Pat

Patrick S. Steerman

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Pursuant to USEPA's request the following email provides supplemental information on the estimated area and anticipated volume of the most heavily NAPL impacted bedrock and clarifications around the bench scale tests (and whether heat was used) for NAPL mobility and residual saturations.

Estimated volume (yd^3) of the most highly contaminated zone (impacted by NAPL) at the site

An estimate of the total mass of NAPL was provided in the TI Waiver Assessment Report based on the measured saturations of NAPL and the lateral and vertical distribution of impacts. Consistent with the information presented in the AGWS Report (2012), the total area of NAPL impacted bedrock covers an area of 40,000 ft^2 and extends to a depth of approximately 20 feet into bedrock. This equates to a total volume of 800,000 ft^3 or 29,600 y^3. This area is shown as the total red shaded area on the attached figure.

The highest NAPL saturations were observed in the area to the east of the former rail spur and in the vicinity of the former gas holders and retort building. This area includes both the area of bedrock impacts (shown as the red hatched area to the east of the former rail spur on the attached figure) and the geoprobe investigation area (as shown by the green hatched area on the attached figure), where impacts likely extend into bedrock.

This combined area of higher NAPL saturations is estimated at 26,400 ft^2 and based on the impacts extending a maximum of 20 feet into bedrock, the volume of impacted rock is 19,555 yd^3.

While higher NAPL saturations are observed within the area to the east of the former rail spur (as described above), the NAPL mass throughout the entire area (29,600 y3) is contributing to dissolved phase impacts in groundwater. As described in the TI Waiver Assessment Report and subsequent response to comment submittals, remediation of the NAPL throughout the entire NAPL affected area or a focused NAPL remediation effort will not accelerate the restoration of groundwater quality.

Clarification on the Centrifugal Test Methods Used to Assess Mobility

A detailed assessment of the mobility and recoverability of NAPL was conducted as part of the AGWS. This evaluation utilized methods to quantify NAPL saturations which are highly aggressive and provide conservative estimates of the unrecoverable and potential mobile fractions. It must be emphasized that these methods provide stresses that are orders of magnitude greater than what can be applied in the field (more aggressive than pilot tests) and therefore the inability to completely remove NAPL in the bench tests provide clear indications that field based techniques will similarly provide limited success.

The methods used for quantifying residual saturation in the sandstone do not utilize heat. Rather, the methods use centrifugal forces (up to 1,000x gravity) to extract NAPL from the rock cores. These methods are standard tests used by the petroleum industry to assess both primary and secondary recovery (water, gas and steam drive) from petroleum reservoirs and provide an optimistic assessment of the volume of NAPL that could be recovered using all technologies. As part of the reservoir modeling, efficiency factors are applied to the model to provide more realistic estimates of the volumes of oil that could be recovered.

The potential for enhanced recovery of NAPL using thermal technologies is limited at this site. Field observations in the areas of peak saturation indicate that the majority of the NAPL is coal tar liquors which are lower viscosity NAPL. As noted in the AGWS Report (2012), these coal tar liquors exhibit viscosities between 10 and 20 cP. Changes in viscosity in response to heating are a function of the molecular weights and boiling points of the compounds present, with larger decreases in viscosity observed for higher molecular weight compounds. Baker et al. (2004) has reported 6-fold decreases in viscosity due to heating in high viscosity compounds (100+ cP). However, for the lower molecular weight

compounds (as reflected by the high proportions of volatile compounds in the NAPL) the changes in NAPL viscosity in response to heating are more incremental (from 20 cP to 10 cP).

While decreases in viscosity will result in increased potential mobility, the fundamental controls on NAPL recoverability at this site (based on NAPL saturation being at or below residual saturation) are the low NAPL saturations, the high water content of the rock and the conductivity of the sandstone. Viscosity for the coal tar liquors is not the primary control on NAPL mobility and recoverability at this site would not be enhanced by heating. On this basis, heating of the saturated zone is anticipated to provide minimal reductions in NAPL saturation.

As noted above, the residual saturations from thermal enhanced recovery are unlikely to be lower than the saturations achieved during the centrifugal bench scale testing. The centrifugal forces applied provide the maximum stresses and maximum declines in NAPL saturation which could be exerted on this type of formation materials. Despite these high centrifugal stresses, the extraction methods were insufficient to provide marked declines in NAPL saturations.

Groundwater modeling was conducted to assess the benefits of NAPL recovery on plume longevity. Based on this assessment, reductions in NAPL saturation (even at the concentrations achievable with the most aggressive bench scale test) and considering all possible technologies, no marked reductions in plume longevity were projected.

It should be noted that the performance of thermal enhanced remediation technologies in bedrock was provided in the Focus Feasibility Study (FFS). The majority of thermally enhanced remediation at MGP sites was conducted in unconsolidated deposits and at sites with large volumes of measurable NAPL in wells. While some success has been observed at thermally enhanced NAPL remediation sites (Baker et al 2006), the study sites are not reflective of the conditions at the CRS site and provide the most favorable conditions for mass recovery. The limited to no mobile fractions and the complexity of site conditions would result in limited incremental recovery at the CRS site. In addition to the limitations of thermal technologies at this site, the FFS also discusses the potential for exacerbation of risk at the CRS site due to the proximity of receptors (adjacent industry sites and the river), which is a key concern and limitation.
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References

Baker, R.S., J.C. LaChance, M.W. Kresge, R.J. Bukowski, J.P. Galligan and M.Kuhlman. 2004. "In-Situ Thermal Destruction (ISTD) of MGP Waste in a Former Gasholder: Design and Installation." *Proceedings of Gas Technology Institute's Natural Gas Technologies II Conference*, Phoenix, AZ, Feb. 8, 2004.

Baker, R.S., D. Brogan and M. Lotti. 2006. "Demonstration of Three Levels of In-Situ Heating for Remediation of a Former MGP Site." Paper L-74 In *Remediation of Chlorinated and Recalcitrant Compounds - 2006: Proceedings of the Fifth International Conference* (May 22-25, 2006). Battelle, Columbus, OH.